Talbot County, Maryland

Water Resources Element

Planning Commission Draft

June 3, 2009

Water Resources Element

The Water Resources Element of the Talbot County Comprehensive Plan creates a policy framework for sustaining public drinking water supplies and protecting the County's waterways and riparian ecosystems by effectively managing point and nonpoint source water pollution. It complies with the requirements of Article 66B of the Annotated Code of Maryland—as modified by Maryland House Bill 1141, passed in 2006.

The Water Resources Element identifies opportunities to manage existing water supplies, wastewater effluent, and stormwater runoff, in a way that balances the needs of the natural environment with the County's projected growth, including the growth projected for the County's municipalities. In this way, this Water Resources Element helps to protect the local and regional ecosystem while ensuring clean drinking water for future generations of Talbot County residents.

Interjurisdictional Coordination
There are five incorporated municipalities in Talbot County. Residents and businesses of four of these communities (Easton, Oxford, St. Michael's, and Trappe) receive public water and/or sewer service (Queen Anne residents and businesses do not receive public water or sewer service). These municipalities own and operate all of the County's public water systems. Easton, Oxford, and Trappe operate their own wastewater treatment plants.

The municipalities are preparing their own Water Resources Elements. However, the County recognizes the importance of interjurisdictional water resources planning. This Countywide Water Resources Element compiles, to the greatest degree possible, up-to-date data from the municipalities, in order to coordinate water resources, growth, and land use planning. Where possible, the County has also obtained data and information on water resources from adjoining Counties, in order to paint the fullest possible picture of future impacts to the Choptank, Wye, and other rivers and streams that form Talbot County's boundaries.

I. Goals

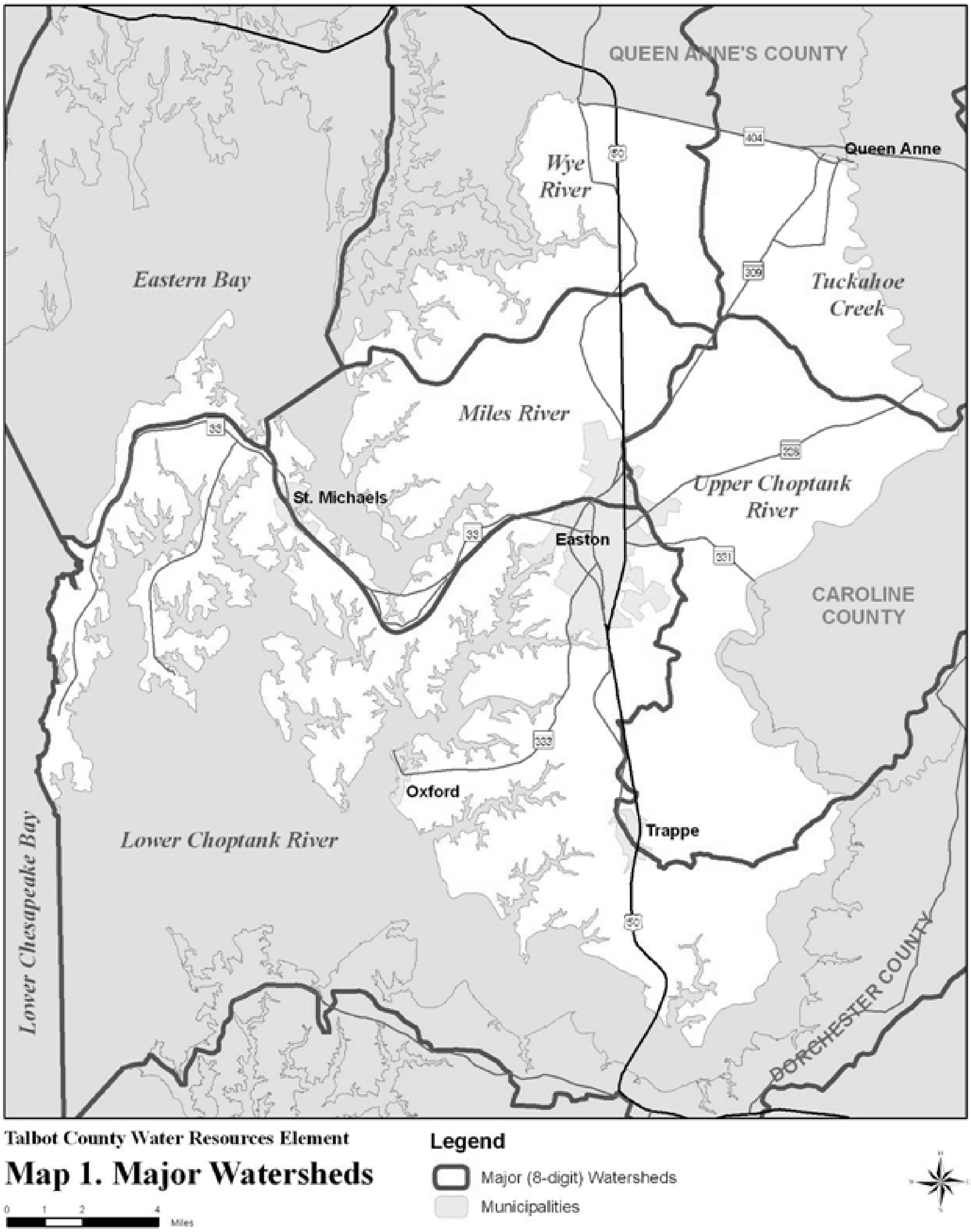
In cooperation with the County's municipalities, maintain a safe and adequate water supply, and adequate amounts of wastewater treatment capacity to serve projected growth.

Take steps to protect and restore water quality, and to meet water quality regulatory requirements in the county's rivers and streams.

II. County Projections and Scenarios

A. Watersheds

This Element takes a watershed-based approach in analyzing the impact of future growth on Talbot County's water resources—particularly in relation to nutrients discharged to the County's streams. Land in Talbot County drains to one of seven major watersheds (or "8-digit watersheds," referring to the numeric classification system used by the Maryland Department of the Environment). These watersheds, shown on Map 1, are: the Eastern Bay, Lower Chesapeake Bay, Lower Choptank River, Miles River, Tuckahoe Creek, Upper Choptank River, and Wye River.



Talbot County Water Resources Element

Map 1. Major Watersheds

B. Population Projections

The Water Resources Element uses Countywide population projections developed by the Maryland Department of Planning (MDP), shown in Table 1. These projections indicate that County population will reach approximately 42,100 by the year 2030, an annual increase of approximately 0.7 percent per year, or 16 percent overall between 2007 and 2030.

The population projections in Table 1 are intended only to support the analyses in the Water Resources Element (as required by the state in HB 1141). The County is concerned that MDP's population projections may underestimate development pressure and future population. The County and its municipalities have granted at least preliminary approval for more than 5,500 housing units not accounted for in MDP's 2030 projections. Three thousand units alone have been approved by the Town of Trappe. A Development Capacity Analysis conducted by MDP showed that more than 20,000 new housing units could eventually be built in the County.

It is understood that some of the "pipeline" (approved but unbuilt) units will not be built and occupied by 2030, and that some completed units will not be occupied by full-year residents. However, the number of units in the "pipeline" does cast some doubt on the state projections. Accordingly, while the data in Table 1 are used throughout this Element, the County's population projections should be thoroughly reviewed and updated as part of a full revision to the 2005 Comprehensive Plan.

Table 1. Population Projections for the Water Resources Element

Year						*Change, 2007-2030*		
2007	**2010**	**2015**	**2020**	**2025**	**2030**	**Number**	**Percent**	**Annual Increase**
36,193	37,050	38,600	40,050	41,250	42,100	5,907	16%	0.7%

Sources:
2007: MDP, 2007 Estimates for Maryland's Jurisdictions
All Other Years: MDP, Projected Total Population for Maryland's Jurisdictions (Revisions, December 2008).

C. Future Development Scenario

A single future development scenario, based on the population projections described above and the 2005 Comprehensive Plan was carried forward for detailed analysis this Water Resources Element. The intent of analyzing a single scenario is to evaluate the sustainability of the County's adopted Comprehensive Plan, and to provide input into the next full revision of the Comprehensive Plan, which would likely occur in 2011. For purposes of the nonpoint source loading analysis (Section VI), the amount of septic denitrification was varied, to show the impact that such a program might have on the County's receiving waters.

Because water and sewer service is often measured in terms of Equivalent Dwelling Units, or EDU,[1] the Water Resources Element uses housing units as the basis for its water, sewer, and nonpoint source pollution analyses. Table 2 shows the projected watershed-level distribution of housing units in the scenario described above. The projected increase of 2,683 housing units represents an increase approximately 13 percent. As shown in Table 2, approximately 70 percent of new housing units would be built in municipalities (including areas likely to be annexed in the future, based on the County's Water

[1] An EDU represents the average amount of water used by one household, and is also used to calculate residential and non-residential (e.g., businesses) water demand. In Talbot County, one ERU equals to 220 gallons per day (gpd).

and Sewer Master Plan).A more detailed account of how these projections were developed is included in the Water Resources Element Appendix.

Table 2. Housing Unit Projections by Watershed

Watersheds	2007 Existing[2]	*2007-2030 Growth* Increment	2030 Total
Eastern Bay	242	85	247
Lower Chesapeake Bay	5	0	5
Lower Choptank River			
Easton[1]	5,224	1,141	6,365
Trappe[1]	368	116	443
St. Michaels[1]	327	5	373
Oxford	963	20	983
Remainder of Watershed	6,077	237	6,314
Miles River			
Easton[1]	896	119	1,015
St. Michaels[1]	693	91	784
Remainder of Watershed	2,087	119	2,206
Tuckahoe Creek			
Queen Anne	48	4	52
Remainder of Watershed	567	103	670
Upper Choptank River			
Easton[1]	506	45	551
Trappe[1]	117	336	453
Remainder of Watershed	1,386	185	1,572
Wye River	677	156	833
Total	**20,183**	**2,683**	**22,866**

Notes:
1: Includes the portion of the municipality (including areas likely to be annexed, based on the Talbot County Water and Sewer Master Plan) that falls within this watershed. For more detail, please see the Water Resources Element Appendix.
2: Source: Maryland Property View 2007

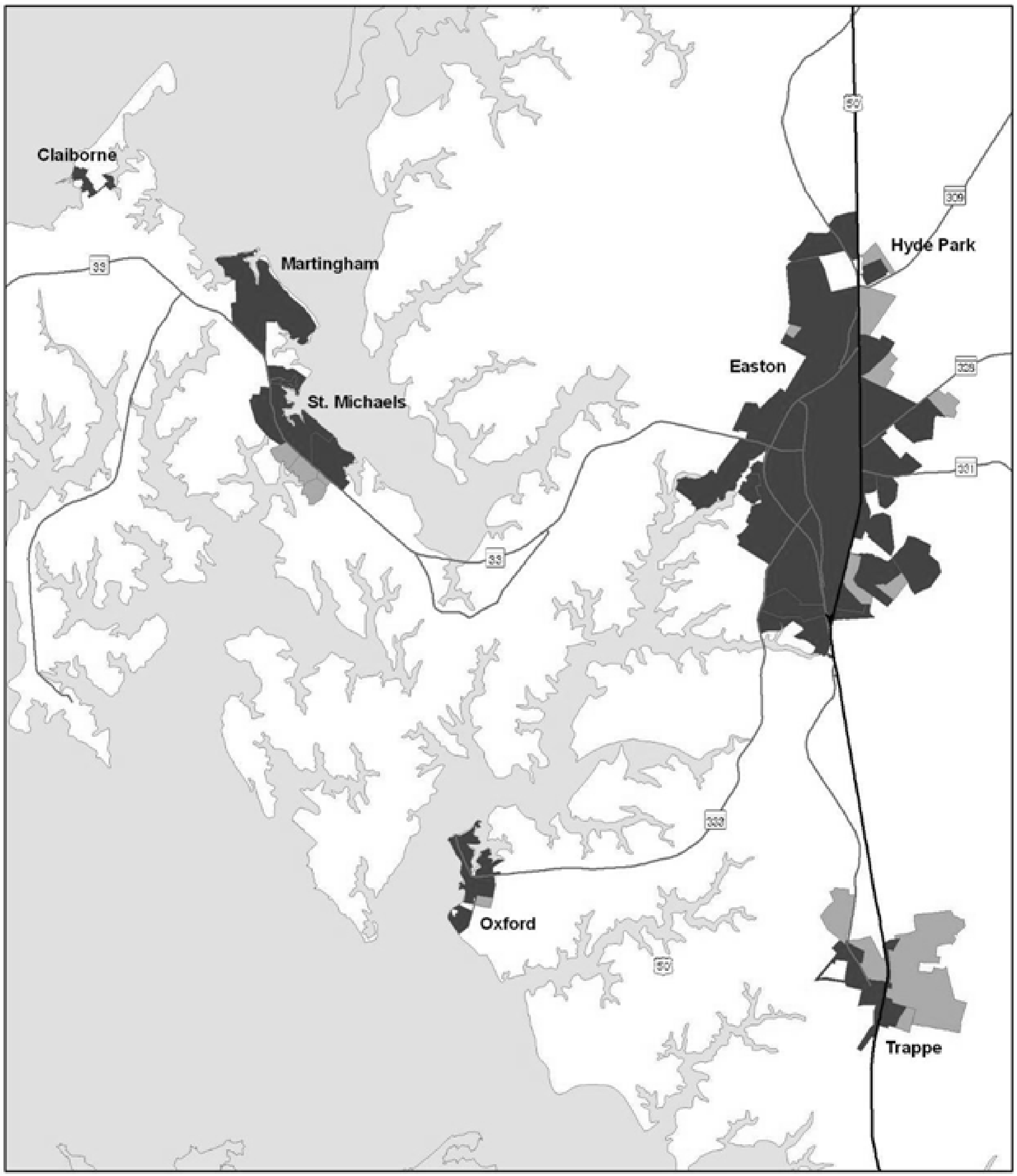
III. Drinking Water Assessment

This section describes existing conditions and projected future demand for drinking water in Talbot County.

A. Public Water Systems

All public and private drinking water in Talbot County is obtained from groundwater. Table 3 summarizes water sources and other characteristics of the public drinking water systems in the County. Map 2 shows the location of these water service areas as of 2008, as well as the areas that are expected to be served within ten years. A more detailed description of the aquifers used by these public systems is included in the Water Resources Element Appendix. More detailed information on existing and proposed future water service areas can be found in the County's Water and Sewer Master Plan.

Approximately 9,600 dwelling units in Talbot County (slightly less than half of all dwelling units in the County) and a considerable share of businesses receive drinking water from municipal public water systems in Easton, Oxford, St. Michaels, and Trappe, as well as community systems in Hyde Park (near



Talbot County Water Resources Element

Map 2. Public Water Systems

Easton), Martingham, (near St. Michaels), and Claiborne. These systems are described in Table 3.

Talbot County does not operate any public water systems. All public water systems are supplied by groundwater wells.

Table 3. Public Drinking Water System Characteristics

Water System[1]	Source Aquifer (number of wells)	Source Concerns / System Issues
Easton	Aquia Greensand, Matawan, Magothy (6)	Elevated arsenic levels
Oxford Area	Aquia Greensand (2)	Elevated arsenic levels
St. Michaels	Aquia Greensand (2)	Elevated arsenic levels
Trappe Area	Piney Point (2)	
Claiborne	Aquia Greensand (2)	System size limitations, leakage. Elevated arsenic levels
Hyde Park	Aquia Greensand (1), Federalsburg (1)	Elevated arsenic levels
Martingham	Aquia Greensand (2)	Elevated arsenic levels

Source: 2002 Talbot County Water and Sewer Master Plan

Table 4 shows existing drinking water demand and system capacity, while Table 5 shows the projected water supplies, demands, surpluses and deficits for these water systems under each of the three scenarios described above.

Table 4. Public Drinking Water System Demand and Capacity, 2007

		Easton	St. Michaels	Oxford	Trappe	Claiborne	Hyde Park	Martingham
Existing Water Production[1]	MGD[2]	3.40	0.32	0.57	0.49	0.26	0.25	0.43
	EDU[3]	13,600	1,300	2,296	1,960	104	100	172
Demand, 2007	MGD	1.68	0.27	0.13	0.13	0.15	0.25	0.43
	EDU	6,704	1,080	512	500	60	100	172
Net Available Capacity, 2007	**MGD**	**1.72**	**0.06**	**0.44**	**0.37**	**0.11**	**0**	**0**
	EDU	**6,896**	**220**	**1,784**	**1,460**	**44**	**0**	**0**

Notes:
1: Indicates the more restrictive of either MDE's groundwater appropriations permit or the system's design capacity.
2: MGD = Million Gallons per Day;
3: EDU = An Equivalent Dwelling Unit (EDU), equal to 220 gpd. This figure represents the average amount of water used by one household, and is also used to calculate residential and non-residential (e.g., businesses) water demand.
Source: 2002 Talbot County Water and Sewer Master Plan; municipalities

All of the major public water systems in the County have available capacity to support some additional growth and development, and all of these systems can support projected growth through 2030. St. Michaels would essentially reach its capacity by 2030, while the Easton, Oxford, and Trappe Systems have considerable available capacity beyond 2030.

Table 5. Public Water System Demand and Capacity, 2030 (Major Systems Only)

		Easton	St. Michaels	Oxford	Trappe
System Capacity, 2030[1]	MGD	3.40	0.32	0.57	0.49
	EDU	13,600	1,300	2,296	1,960
Demand, 2007	MGD	1.68	0.27	0.13	0.13
	EDU	6,704	1,080	512	500
Projected New Residential Demand, 2008-30	MGD	0.33	0.02	< 0.01	0.11
	EDU	1,305	96	20	452
Projected New Non-residential Demand, 2008-30[2]	MGD	.05	< 0.01	0	0.02
	EDU	196	14	0	68
New Demand from System Extensions[3]	MGD	0.07	0.01	< 0.01	0.01
	EDU	276	52	31	45
Total Projected New Demand, 2008-30	MGD	0.44	0.04	0.01	0.14
	EDU	1,776	162	51	564
Total Demand, 2030	**MGD**	**2.12**	**0.31**	**0.14**	**0.27**
	EDU	**8,480**	**1,242**	**563**	**1,064**
Net Available Capacity, 2030	**MGD**	**1.28**	**0.01**	**0.43**	**0.22**
	EDU	**5,120**	**58**	**1,733**	**896**

Notes:
1: Incorporates all ongoing or planned capacity upgrades.
2: Estimated. Assumes that new nonresidential development in Towns is 15% of residential development, based on existing (2007) ratios of nonresidential EDUs to residential EDUs in Towns.
3: Source: Maryland Property View 2007 and Talbot County Water and Sewer Master Plan. Based on acreage of active non-residential properties, using 0.892 EDU per acre, the default value in the MDE nonpoint source model.

B. Other Water Use

In 2002, there were 329 active groundwater appropriation permits in Talbot County, drawing a daily average of 6.4 MGD. All residential units and businesses in Talbot County outside of the above public water systems rely on individual or community wells. These wells are drilled in a variety of water-bearing formations, particularly the Columbia (or surficial aquifer), Miocene (typically the Calvert formation), Piney Point, and Aquia aquifers. [2]

Table 6 shows the distribution of Countywide water use in 2000. Although not a precise representation of current water use, Table 6 does highlight the County's major water users: public systems, private residential users, and agricultural irrigation. The remainder of this section discusses those major categories of non-public water users in greater detail.

[2] Source: MGS. 2005. Hydrogeology of the Coastal Plain Aquifer System in Queen Anne's and Talbot Counties. Accessed at http://www.mgs.md.gov/hydro/qatalsum.html

Table 6. Freshwater Withdrawals in Talbot County, 2000

Type of Withdrawal	*Total Withdrawals (MGD)* Surface Water	Groundwater	Total	Percent of County Withdrawals
Commercial	0	0.36	0.36	6%
Industrial	0	0.64	0.64	11%
Mining	0	0.01	0.01	< 1%
Livestock Watering	0.03	0.21	0.24	4%
Aquaculture	0	0.01	0.01	< 1%
Irrigation	0.40	0.44	0.84	14%
Residential self-supplied	0	1.58	1.58	26%
Public Supply	0	2.32	2.32	39%
Total	**0.43**	**5.57**	**6.00**	**100%**

Source: USGS MD-DE-DE Water Science Center http://md.water.usgs.gov/freshwater/withdrawals/

Private Residential Wells

Approximately 10,500 residential units in Talbot County rely on individual wells (or, in a few cases such as mobile home parks, community wells) for drinking water supply, as do most businesses in rural portions of the County. These residential and small commercial uses accounted for approximately 1.58 MGD of groundwater withdrawal in 2000. Private residential wells typically draw water from the Miocene, Piney Point, and Aquia aquifers. The Piney Point aquifer is most frequently used in the western and southern portions of the County, while the Aquia and Miocene aquifers are most frequently used in the central portion of the County. Some older residences, particularly in the northern and eastern portions of the County, continue to draw from the Columbia (surficial) aquifer.

Major Commercial and Industrial Users

As shown in Table 6, commercial and industrial activities outside of municipal systems account for approximately one-fifth of all water used in Talbot County. The largest concentrations of such water use are found in Cordova (including the Allen Family Foods facility), and in areas adjacent to (and scheduled to receive future public water service from) Easton and Trappe. The majority of non-municipal commercial/industrial water use is scattered throughout the County's rural areas, typically along US 50 and other major roads.

Agricultural Water Users

As is the case throughout the Eastern Shore, Talbot County's farmers employ irrigation using surface water and groundwater. Irrigation is most frequently used in areas to the south and east of Easton. Most surface water used for irrigation is drawn from Tuckahoe Creek. Groundwater for irrigation is generally drawn from the surficial aquifer.

C. Issues and Discussion – Water

Groundwater Recharge

Talbot County's public and private water users draw drinking water from several major confined groundwater aquifers, many of which (particularly the Aquia and Piney Point) are widely used throughout the Eastern Shore. The capacity of these confined aquifers is increasingly strained by new development throughout the Delmarva Peninsula. The US Geological Society (USGS) reports that "withdrawals from Maryland Coastal Plain aquifers have caused ground-water levels in confined aquifers to decline by tens to hundreds of feet from their original levels. Continued water-level declines could affect the long-term sustainability of ground-water resources in agricultural areas of the Eastern Shore."[3] In most cases, the recharge areas for these aquifers (particularly the Piney Point and Aquia), are not necessarily found on the Eastern Shore.

Groundwater and surface water resources are also linked. Water from surficial aquifers can comprise a significant amount of the base flow of streams and rivers. While groundwater withdrawn through wells is typically returned to the ground or surface via point source discharges, septic systems, and absorption of runoff from outdoor water uses (such as watering of lawns), large withdrawals can potentially impact the quality and quantity of flows in nearby surface water bodies.

There exists no comprehensive study of the water-bearing formations used by Talbot County residents and businesses. Individual (e.g., project-specific) groundwater studies do not take into account the cumulative impacts of heavy demand on the Aquia and other formations from both the Eastern and Western Shore. In addition, the Water Balance methodology recommended by *Models and Guidelines #26* (the state's official guidance for preparation of the Water Resources Element) is not applicable for the Coastal Plain. Thus, while the County understands that its groundwater supplies are limited and declining, there is no reliable measure of water supply against which to compare current and especially projected water demands.

MDE, the Maryland Geological Survey (MGS), and the US Geological Survey (USGS) have begun work on a Coastal Plain Aquifer Study, but that study remains incomplete. The County should use the data and recommendations of the Coastal Plain Aquifer Study (once completed) to shape its own water use policies and ordinances. However, the County also recognizes the need for and supports the development of broader regional water policies to protect already scarce resources.

For purposes of this Water Resources Element (and lacking specific evidence to the contrary), this Water Resources Element presumes that the MDE groundwater permit issued for each public drinking water system reflects the maximum safe yield of the aquifer(s) used by that system.

Water Quality

Elevated levels of naturally-occurring arsenic are known to be present in the Aquia aquifer, the primary aquifer used by the County's public drinking water systems. Treatment of water to remove arsenic is costly for public utilities. Saltwwater intrusion in the Aquia is a known problem on Kent Island (in Queen Anne's County), and may also be a concern in coastal areas of Talbot County. This problem will only increase as the aquifer is drawn down.

In addition to these concerns about water quality in the Aquia, individual wells in the surficial aquifer are at risk for elevated nitrate levels due to cross-contamination from failing or inadequate septic systems, or agricultural fertilizer.

[3] Source: USGS. 2006. Sustainability of the Ground Water Resources in the Atlantic Coastal Plain of Maryland. USGS Fact Sheet 2006-3009

Groundwater Protection

The Talbot County Groundwater Protection Plan (GPP) was developed in 1987, and identifies areas where septic systems may be allowed. The GPP establishes the design criteria and construction requirements for all septic systems, and divides the County into two management areas. Management Area A designates areas that require maximum protection of shallow groundwater aquifers, while Management Area B designates areas where the aquifers used for septic system disposal are separated from drinking water aquifers.

The GPP is adopted as an appendix to the County's Water and Sewer Master Plan, and is enforced by the Talbot County Health Department. An excerpt of the GPP describing the two Management Areas in Talbot County is included in the Water Resources Element Appendix.

Water Conservation

The County and its municipalities actively implement the Maryland Water Conservation Plumbing Fixtures Act (MWCPFA), which requires that new plumbing fixtures sold or installed as part of new construction are designed to conserve water. In addition, the Water and Sewer Master Plan enumerates several benefits of water conservation, and encourages water conservation as an official policy. The County and its municipalities actively encourage water conservation through education and water use monitoring.

Potential New Water Supplies

Water supplies appear adequate to support projected development within municipalities (through 2030), but the longer-term picture is less clear, particularly given the scarce nature of groundwater resources on the Eastern Shore. To accommodate long term growth, the County and its municipalities should begin to investigate the feasibility of other sources of drinking water, including different aquifers and surface water bodies.

Although not widely used for water supply, the Matawan, Patapsco, and Upper and Lower Patuxent formations are present under Talbot County. The Town of Easton draws some of its water from the Matawan, while the other aquifers listed above are not widely used for water supply.[4] More detailed investigation is necessary to determine whether the water in these aquifers is of sufficient quality (particularly with relation to hardness, dissolved solids, and iron) and can produced in sufficient quantity for human consumption. The aquifers listed above also occur at significantly greater depths than the Aquia and Piney Point, adding to the cost of wells for new development (or new wells to serve existing systems).

Surface water impoundments are not currently used for drinking water in Talbot County. Although the County has access to the Choptank and other moderate-sized rivers, preparing surface water for public consumption can also be costly and difficult. All of the County's major rivers are impaired by nutrients, and several are also impaired by a variety of other pollutants, including biological material, bacteria, and sediments. Surface water cannot be ruled out as a potential new source of drinking water, and should be included in any comprehensive study of new drinking water sources. However, the County acknowledges that surface water will not likely be the preferred new source.

[4] Source: MGS. 2005. Hydrogeology of the Coastal Plain Aquifer System in Queen Anne's and Talbot Counties. Accessed at http://www.mgs.md.gov/hydro/qatalsum.html

To address concerns about water supplies, many Maryland counties have begun to investigate the feasibility of withdrawing and treating brackish tidal waters for public water supplies. The desalinization technology necessary for such systems is expensive and energy-intensive. However, it should also not be ruled out over the very long term.

IV. Wastewater Assessment

This section describes existing conditions and projected future demand for public wastewater treatment capacity in Talbot County.

A. Public Sewer Systems

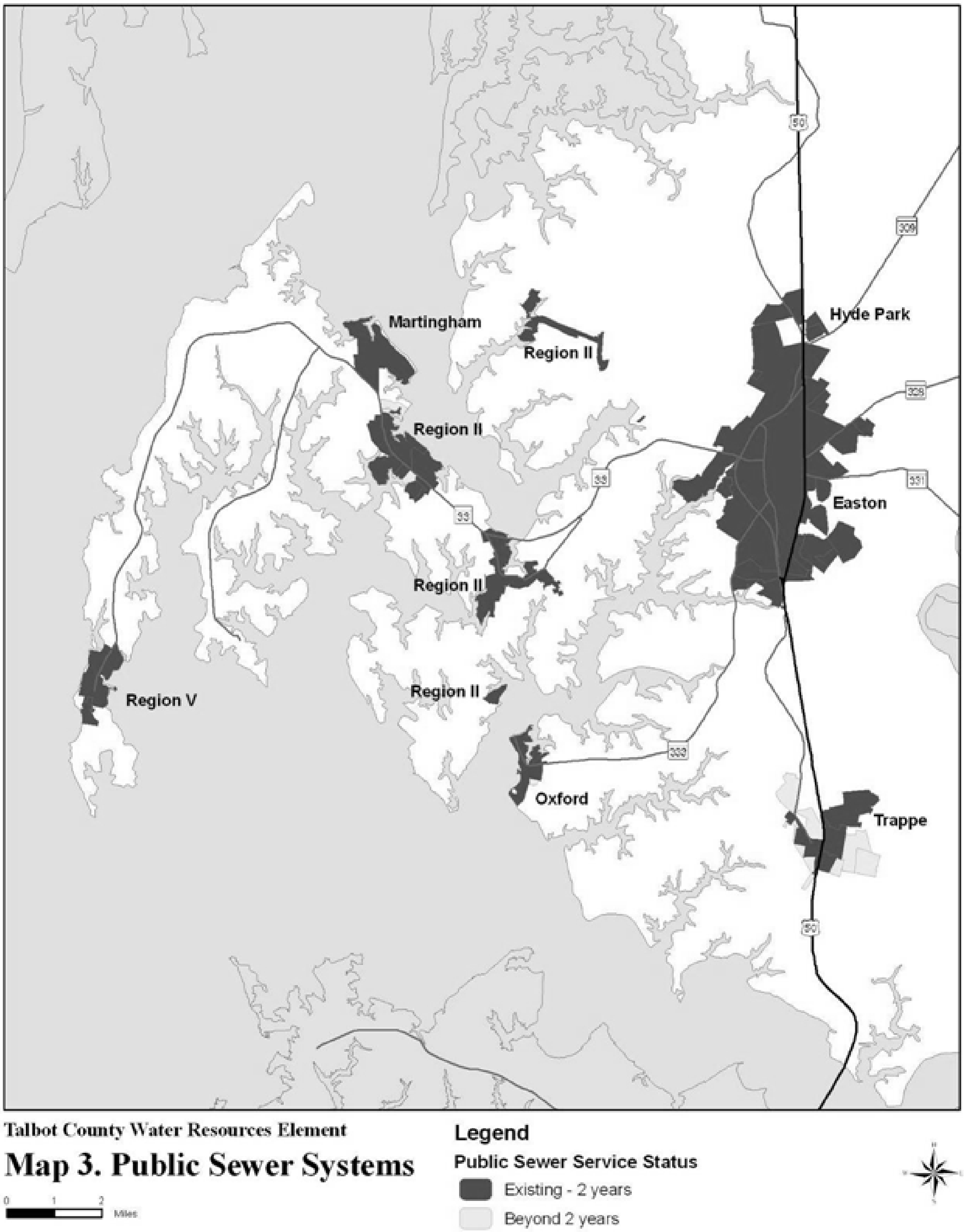
Approximately 10,500 dwelling units in Talbot County (slightly more than half of all dwelling units in the County) and a considerable share of businesses discharge wastewater to one of the nine County, municipal, or private (community) wastewater treatment plants (WWTP) described in Table 7. Map 3 shows the location of public sewer service areas as of 2008 (the most recent year for which mapping is available), as well as the areas that are expected to be served within ten years.

Table 7. Public Sewer System Characteristics

Wastewater Treatment Plant	Discharge Location (Watershed)	Treatment Technology	Planned/Potential Upgrades or Expansions
Public Systems			
Region V (Tilghman)	Chesapeake Bay (Lower Chesapeake)	Lagoons	Potential upgrade/expansion
Easton	Upper Choptank River	Enhanced Nutrient Removal (ENR)	Service to additional areas around Easton
Oxford	Town Creek (Lower Choptank River)	Lagoons	Potential phosphorus upgrade, relocated discharge point.
Trappe	La Trappe Creek (Lower Choptank River)	Biological Nutrient Removal (BNR)	Likely upgrade/expansion of existing WWTP and/or construction of new WWTP.
Region II (St. Michaels)	Miles River	ENR	None planned
Private/Community Systems			
Hyde Park	Onsite Bermed Infiltration Pond		Repairs to failed infiltration pond.
Martingham	Lagoons and spray irrigation		Flow temporarily diverted to Region II during repair/upgrade.
Preserve at Wye Mills	Onsite Spray Irrigation	BNR	None planned

Source: 2002 Talbot County Water and Sewer Master Plan

Talbot County owns and operates two public WWTPs, Region V and Region II. The Region V system serves Tilghman Island. Region II serves the Town of St. Michaels, as well as the Rio Vista, Royal Oak, Newcomb, Bellevue, Tunis Mills, Unionville, and Copperville areas in the western portion of the County. Table 8 shows existing public sewer system demand and system capacity, while Table 9 shows the projected public sewer supplies, demands, surpluses and deficits for these wastewater systems in 2030.


Martingham
Region II
Region II
Hyde Park
Easton
Region II
Region V
Region II
Oxford
Trappe
50
309
328
331
33
33
333
50
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Map 3. Public Sewer Systems
0 1 2 Miles
Legend
Public Sewer Service Status
Existing - 2 years
Beyond 2 years

As of 2009, effluent from the Martingham system was temporarily being diverted to the Region II facility while repairs and upgrades to the Martingham system are made. (These flows are not included in Table 8, which is intended to convey standard operating demands and capacity).

All of the County's major public sewer systems have available capacity to support some additional growth and development. The Region V and Trappe Area WWTPs do not appear to have adequate capacity to accommodate projected growth through 2030. This is especially true in Trappe, where development of up to 3,000 new housing units could occur on approximately 1,200 acres of recently annexed land (this Element assumes that a portion—but not all—of that potential development would occur by 2030).

Table 8. Public Sewer System Demand and Capacity, 2007

		Region II (St. Michaels)	Region V (Tilghman)	Easton[4]	Oxford	Trappe
System Capacity, 2030[1]	MGD	0.66	0.15	4.00	0.10	0.22
	EDU	2,640	600	16,000	416	880
Average Daily Flow, 2007	MGD	0.37	0.09	2.61	0.09	0.20
	EDU	1,460	368	10,440	360	800
Projected New Residential Demand, 2030	MGD	0.02	0	0.33	< 0.01	0.11
	EDU	96	0	1,305	20	452
Projected New Non-Residential Demand, 2030[2]	MGD	<0.01	0	0.05	< 0.01	0.02
	EDU	14	0	196	3	68
Dormant Allocations, Demand from System Extensions[3]	MGD	0.13	0.06	0.02	0	0
	EDU	538	256	76	0	0
Total Projected New Demand, 2008-2030	MGD	0.16	0.06	0.39	<0.01	0.13
	EDU	648	256	1,577	23	520
Total Demand, 2030	**MGD**	**0.53**	**0.16**	**3.00**	**0.10**	**0.33**
	EDU	**2,108**	**624**	**12,017**	**383**	**1,320**
Net Available Capacity, 2030	**MGD**	**0.13**	**(0.01)**	**1.00**	**< 0.01**	**(0.11)**
	EDU	**532**	**(24)**	**3,983**	**33**	**(440)**

Notes:
1: Incorporates all ongoing or planned capacity upgrades.
2: Estimated. Assumes that new nonresidential development in Towns is 15% of residential development. See note in Table 5.
3: Source: Maryland Property View 2007 and Talbot County Water and Sewer Master Plan. Based on acreage of active non-residential properties, using 0.892 EDU per acre, the default value in the MDE nonpoint source model.
4: Assumes that effluent from the Hyde Park system will eventually be directed to the Easton WWTP.

B. Nutrient Discharges and Assimilative Capacity

Nitrogen and phosphorus (more generally referred to as "nutrients") from WWTPs and from stormwater and other "non-point sources" are the primary contributors to degraded water quality in the Chesapeake Bay and its tributaries. As a result of Maryland's participation in the Chesapeake Bay 2000 Agreement, and resulting state policies designed to help restore the Bay, water and sewer planning must take into account the "assimilative capacity" of a receiving body of water—the mass of nutrients that the stream can receive while still maintaining acceptable water quality. This section describes the key limits on assimilative capacity as they apply to the County's WWTPs.

TMDL

One measure of assimilative capacity is the Total Maximum Daily Load (TMDL), a series of calculations required by the Clean Water Act. A TMDL is the maximum amount of pollutant that a water body, such as a river or a lake, can receive without impairing water quality. Water bodies are classified as "impaired" when they are too polluted or otherwise degraded to support their designated and existing uses. The TMDL is typically expressed as separate discharge limits from point sources such as WWTPs, as well as non-point sources such as stormwater or agricultural runoff.

The impaired waters list is called the 303(d) list, named after the section in the Act that establishes TMDLs. All of Talbot County's 8-digit watersheds are impaired for nutrients (nitrogen and/or phosphorus). However, completed nutrient TMDLs are not available for any of these watersheds[5].

Point Source Caps

To address nutrient loads from point sources such as WWTPs, the state has established Chesapeake Bay Tributary Strategy point source caps. These caps are numerical limits on the amount of nitrogen and phosphorus that WWTPs can discharge to the Bay and its tributaries (expressed as pounds per year of nitrogen and phosphorus). Nitrogen and phosphorus point source caps have been established for the Region II and Easton WWTPs. A phosphorous cap has been established for the Trappe WWTP and a nitrogen cap has been established for the Oxford WWTP.

Point Source Discharges

Table 10 lists these nutrient caps, as well as existing and projected future nutrient discharges for the County's major WWTPs. This Water Resources Element assumes that by 2030, the Region V and Oxford WWTPs will both be upgraded to BNR technology, and that the Trappe WWTP would be upgraded to ENR. Such upgrades are not yet planned, but will likely be necessary to support projected growth.

Upgrade of the Region V WWTP would trigger the establishment of a nutrient cap for that facility. As shown in Table 10, the default cap for minor facilities (those that discharge less than 0.5 MGD) is 6,100 lbs/year of nitrogen and 457 lbs/year phosphorus, although MDE's discharge permit may reflect a lower cap, based on the agency's site-specific analysis. The Region V facility may need to go beyond BNR or consider alternative effluent disposal methods (see below) to meet the phosphorus cap. A similar situation may exist for the upgraded Oxford WWTP by 2030.

Even with ENR upgrades, it appears that the Trappe WWTP will not be able to meet the very stringent phosphorus cap imposed by the TMDL for La Trappe Creek—the WWTP's current discharge point. In evaluating WWTP upgrades and expansions to accommodate new growth, the Town of Trappe may therefore need to consider relocation of its outfall pipe, or alternative effluent disposal methods.

[5] A phosphorus TMDL has been completed for a portion of La Trappe Creek—a tributary of the Lower Choptank River—which impacts the Trappe WWTP. However, the TMDL for the Lower Choptank River as a whole has not been completed.

The Region II and Easton WWTPs have adequate nitrogen and phosphorus discharge capacity to support projected growth through 2030 and beyond.

Table 10. Projected Point Source Nutrient Discharges, 2030

		Region II	Region V	Easton[5]	Oxford	Trappe
Existing Nutrient Loads[2]	TN[1]	5,000	5,000	23,800	4,900	4,900
	TP[1]	603	1,700	2,400	1,600	183
Likely Nutrient Caps, 2030[3]	TN	8,040	6,100	48,729	5,621	6,100
	TP	603	457	3,655	457	183
Projected ADF, 2030	MGD	0.53	0.16	3.00	0.10	0.33
Assumed Treatment Technology, 2030		ENR	BNR	ENR	BNR	ENR
Estimated Nutrient Discharges, 2030[4]	TN	4,810	3,794	27,415	2,330	8,029
	TP	481	948	2,742	583	301
Remaining Discharge Capacity	**TN**	**3,230**	**2,306**	**21,314**	**3,291**	**(1,929)**
	TP	**122**	**(491)**	**913**	**(126)**	**(118)**

Notes:
1: TN = Total Nitrogen (lbs/year); TP = Total Phosphorus (lbs/year)
2: Sources:
Region II and Easton: MDE's ENR Fact Sheets (http://www.mde.state.md.us/Water/CBWRF/pop_up/enr_status_map.asp); Trappe based on TMDL for La Trappe Creek. All others approximated based on 2007 ADF, 18 mg/L TN, and 6 mg/L TP, or 8 mg/L TN and 2 mg/L TP for BNR facilities.
3: Sources:
Region II and Easton: MDE's ENR Fact Sheets (http://www.mde.state.md.us/Water/CBWRF/pop_up/enr_status_map.asp); Trappe based on limit set by TMDL for La Trappe Creek. All other caps reflect MDE's baseline for minor WWTPs, after BNR upgrade. Actual caps may be lower.
4: Assumes discharge concentrations of 3 mg/L TN and 0.3 mg/L TP for ENR; 8 mg/L TN and 2 mg/L TP for BNR
5: Assumes that the Hyde Park system will be connected to the Easton system by 2030

Antidegradation

Maryland's antidegradation policy significantly limits new discharge permits that would degrade water quality in Tier II (high quality) waters, as defined by the US Environmental Protection Agency (EPA) (MDE 2008). In these areas, new nutrient discharges can be permitted, as long as they do not degrade existing water quality. Maryland does not have any waters designated for Tier III, but Talbot County has four stretches of Tier II waters, as shown in Map 4: portions of Highfield Creek, Jadwins Creek, Kings Creek, and Skipton Creek. None of the WWTPs listed in Table 7 discharge to Tier II waters.

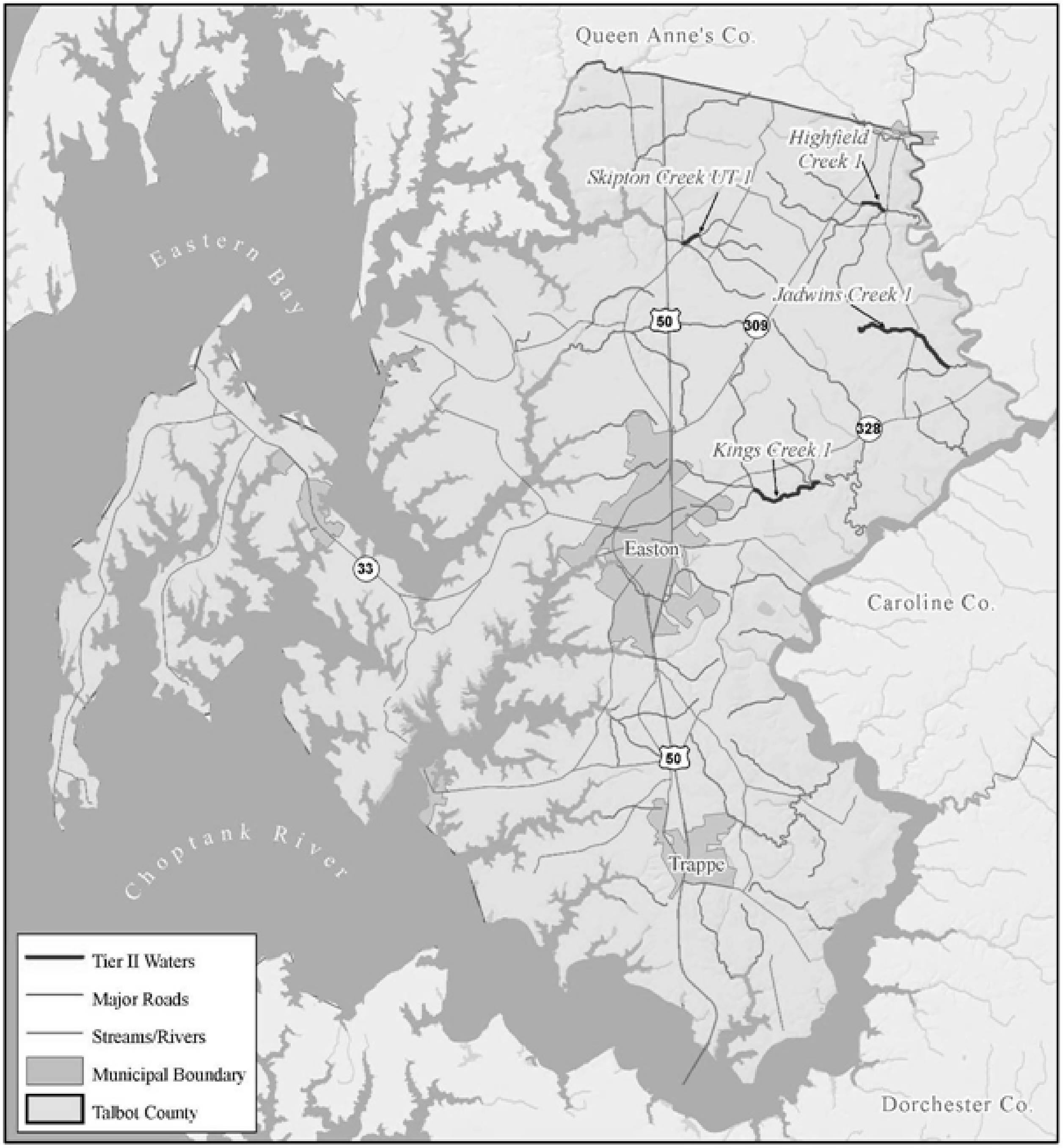
C. Alternative Wastewater Disposal Options

A number of other opportunities exist to protect and improve water quality while still accommodating projected growth and development. This section summarizes key concepts that the County and its municipalities may wish to consider.

Land Application of Treated Wastewater

The application of treated wastewater effluent directly to the soil can allow pollutants to be absorbed before the effluent reaches receiving streams. Spray irrigation is the most common form of land application, although other options (such as drip irrigation or subsurface discharge) can also be considered. Spray irrigation is already used as a disposal method for the Martingham and Preserve at

Wye Mills systems, and may be appropriate for larger public systems in addition to, or instead of point source outfalls.



MAP 4: High Quality (Tier II) Waters in Talbot County
Source: MDE, http://www.mde.state.md.us/assets/document/hb1141/talbot/Talbot_County.pdf

The Preliminary Spray Irrigation Site Capacity Estimate tool provided in *Models and Guidelines #26*, the state's guidance document for the preparation of the Water Resources Element, was used to analyze opportunities for spray irrigation in Talbot County. Based on this analysis, more than 53,000 acres of land are suitable for more detailed investigation to determine suitability for land application. Factors such as slope, soil depth and granularity, water table depth and behavior, and buffers from streams and developed areas are important in determining true suitability.[6]

Beyond soil and water table characteristics, other important considerations for land application include storage and seasonal restrictions. Land application systems typically require large storage lagoons capable of holding several months' worth of effluent. Land application may not be permitted during winter months, when frozen soil cannot accept effluent, or during other months when water tables rise. Any future land application system would likely be paired with the nearby surface discharge to maximize system capacity without exceeding nutrient caps or TMDLs.

Those caveats notwithstanding, there does appear to be an opportunity for public wastewater systems to utilize land application as an alternative or enhancement to surface water discharge. Based on the potential deficiencies identified in Table 10, as well as its proximity to soils with appropriate drainage characteristics, the Trappe WWTP is the most likely candidate system for spray irrigation.

Tertiary Treatment Wetlands

In this system, effluent is treated at a WWTP (either BNR or ENR) and then discharged into a series of constructed, vegetated (typically, forested) wetlands. These wetlands purify the effluent to the point where the eventual discharge is essentially free of nutrients and other pollutants. The best-known application of this technology occurs in Clayton County, Georgia. In this system (which treats 9.3 million gallons of wastewater per day), the wetland-treated effluent is pure enough to be used for drinking water.[7]

Other smaller applications of tertiary treatment wetlands can be found throughout Maryland. These facilities are typically used at schools and other institutional uses. Implementation of such a facility would depend heavily on soil characteristics and other conditions.

Wastewater Reuse

In some cases, treated wastewater effluent can be used to recharge groundwater aquifers. As with tertiary treatment wetlands, effluent is treated to potable (or better) standards before being injected into the aquifer. One such large-scale system is in place in Orange County, California.[8] In that system, treated effluent is used not only to recharge the aquifer (and to provide some drinking water as a result), but also to halt and even reverse saltwater intrusion from the Pacific Ocean into the aquifer. Given the documented drops in aquifer levels on the Eastern Shore, and the presence of saltwater intrusion in some areas (notably the Aquia aquifer on Kent Island), this approach may have merit in Talbot County, and particularly for the Aquia aquifer. The County should work with MDE to investigate the feasibility of such a system.

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[6] Please see the Water Resources Element Appendix for further detail on this calculation.

[7] For more information, see http://www.ccwa1.com/operations/water.reclamation.aspx

[8] For more information, see http://www.gwrsystem.com/

Nutrient Trading

Under the state's Policy for Nutrient Cap Management and Trading,[9] one of the County's WWTPs could agree to forego a certain amount of development in exchange for payment, and then send or "trade" that excess treatment capacity to another WWTP on the Eastern Shore in need of capacity. The receiving WWTP would then be allowed to expand beyond its current permitted capacity, provided that such expansion does not exacerbate existing water quality impairments or violate TMDL requirements.

With a large existing and projected capacity surplus, the Easton WWTP is best able to take advantage of this system, although the need to do so is less certain, given the County's and Easton's emphasis on concentrating growth in and around existing public services.

WWTPs with ENR technology may also be able to expand their facilities by accepting effluent from other WWTPs without BNR or ENR technology, and then by retiring those WWTPs and their outfalls. For example, it is likely that the Hyde Park WWTP might eventually be retired, with flows from the community diverted to the nearby Easton collection system. Although the cost of sewer infrastructure (specifically new pipes) is considerable, such arrangements may be desirable to address future nutrient cap issues at the Region V and Oxford WWTPs.

In addition, MDE and the Maryland Department of Agriculture (MDA) are developing guidelines that would allow trades between nonpoint sources (such as agriculture) and point sources. The County should work with the municipalities to identify and prioritize areas of failing septic systems and other nonpoint source pollution "hot spots" for potential inclusion in any trading system.

V. Programmatic Assessment of Nonpoint Source Policies

Nonpoint sources of nutrient pollution include agricultural run off, erosion and sediment from development, stormwater runoff from roads, atmospheric deposition, and any other source other than an outfall pipe. These sources are called nonpoint because they involve widely dispersed activities, and hence are difficult to measure. All non-point sources of pollution eventually reach the waters of the Chesapeake Bay unless filtered or retained by some structural or nonstructural technique.

Various technologies reduce nutrients from agricultural and developed lands. Nutrient reduction technologies for nonpoint source pollution are generally referred to as "Best Management Practices" (BMPs). Examples of these technologies include animal waste storage, agricultural nutrient management planning, stormwater settling ponds, and erosion controls. Natural controls or "low-impact development techniques are extremely effective in reducing the amount of pollutants that reach waterways. Woodlands and wetlands release fewer nutrients into the Bay than any other land use. For these reasons, forests, grasslands, and wetlands are critical to restoring and maintaining the health of the aquatic environment.

This section characterizes the policies and procedures in place to manage nonpoint source pollution in Talbot County.

A. Maryland Stormwater Design Manual

The 2000 Maryland Stormwater Design Manual, Volumes I & II is incorporated by reference into the Talbot County Code, and serves as the official guide for stormwater methods, principles, and practices.

[9] Information available at: http://www.mde.state.md.us/Water/nutrientcap.asp

The 2007 Maryland Stormwater Management Act mandates substantial revision of the Stormwater Design Manual. The most notable provision of the 2007 Act is the requirement that new development use Environmentally Sensitive Design (ESD) techniques, which are intended to "maintain pre-development runoff characteristics" on the site.[10] ESD emphasizes the minimization and treatment of stormwater on each parcel through a variety of small-scale techniques that mimic natural stormwater absorption and dispersal processes.

As of early 2009, the revised Maryland Stormwater Design Manual and accompanying model regulations are available in draft form. The County should revise its Stormwater Management Ordinance to incorporate the forthcoming revision of the Maryland Stormwater Design Manual and other enhanced stormwater management policies recommended by MDE, pursuant to the Stormwater Management Act of 2007.

B. Other Nonpoint Source Management Policies and Considerations

Septic Denitrification. As of 2009, approximately 75 residential and commercial septic systems in Talbot County had denitrification units. The County Department of Public Works' objective is to retrofit approximately 100 existing systems per year with denitrification units, utilizing the state's Bay Restoration Fund. The County does not currently require denitrification units for new septic systems, but may wish to consider such requirements, particularly in the Chesapeake Bay Critical Area, where nutrients and other pollutants are more easily transmitted to receiving waters.

Scenario 1 for the nonpoint source analysis (Section VI) assumes that half of all new rural (i.e., not connected to a public sewer system) residential and commercial development will utilize denitrification units, and that denitrification retrofits will continue at the pace of 100 per year through 2030. Although not explicitly a goal of the County's existing Comprehensive Plan, this level of implementation is reasonably foreseeable in the next two decades.

Stormwater Retrofits. Stormwater retrofits can help to reduce nonpoint source pollution, particularly in more densely developed areas. The County should identify locations where such retrofits could address concentrations of nonpoint source pollution ("hot spots"), or where retrofits can help to protect environmentally sensitive areas. Future retrofit funds and implementation activities should be targeted to these priority areas.

Sedimentation and Erosion. Sedimentation and other impacts resulting from construction activity, and increased stormwater flows to streams and rivers from development are also a potential threat to water quality. Most new non-agricultural development in Talbot County requires a sedimentation and erosion control plan.

Open Section Roads. Outside of towns and populated areas where pedestrian facilities are a priority, new roads in the County should continue to be developed with open sections (i.e., without curb and gutter), to better disperse stormwater.

[10] Source: MDE. http://www.mde.state.md.us/assets/document/act%20-%20a%20state%20perspective.pdf

VI. Total Nutrient Loads and Assimilative Capacity

Nutrient loads from point sources (WWTPs), stormwater, and other nonpoint sources are major contributors to degraded water quality in the Chesapeake Bay and its tributaries. This section evaluates existing and projected point and nonpoint source pollution loads.

A. Nonpoint Source Nutrient Loading

Table 11 shows the estimated existing and future nonpoint source loading (nitrogen and phosphorus) in each 8-digit watershed in Talbot County.

The County's 2005 Comprehensive Plan is due to be reviewed in 2011. The County feels that this full Comprehensive Plan review is the appropriate place to consider alternative land use scenarios, while the Water Resources Element should characterize the impacts of the current Plan (as expressed by zoning and municipal growth). In the interim, the County does wish to understand the impacts that septic denitrification policies would have on nonpoint source pollution.

Table 11: Current and Projected Future Nonpoint Source Loading[1]

(all data in lbs/year)	*Existing*		*TN[2]*			
Watershed	**TN**	**TP**	*Scenario 1*	*Scenario 2*	*Difference*	*TP All Scenarios*
Eastern Bay	32,512	2,607	19,836	19,840	4	1,746
Lower Chesapeake Bay	217	5	161	161	0	4
Lower Choptank River	797,621	64,715	496,799	497,755	956	43,220
Miles River	309,995	25,358	194,995	195,777	782	16,957
Tuckahoe Creek	194,445	16,429	114,924	115,305	381	11,065
Upper Choptank River	410,001	34,094	245,315	246,204	889	22,934
Wye River	246,323	20,830	137,268	137,648	380	14,015
Total Nonpoint Source	**1,991,113**	**164,039**	**1,209,299**	**1,212,690**	**3,391**	**109,941**

Notes:

1: Includes septic systems.

2: Septic assumptions for Scenario 1: 50% of new residential and nonresidential development uses denitrification, plus 2,100 EDU of retrofits for denitrification (100 per year from 2009 through 2030). Septic assumptions for Scenario 2: 2,100 EDU of retrofits only.

The nonpoint source loadings in Table 11 therefore reflect two scenarios. Scenario 1 assumes that half of all new rural development would include septic denitrification units, and that septic retrofits would continue at the pace of 100 EDU per year. Scenario 2 assumes only the septic retrofits, with no requirement related to new development.

Nonpoint source nutrient loads (including septic systems) were estimated using methodology developed by the Maryland Department of the Environment, as modified by the County to reflect revised nutrient loading rates. More detail on the nonpoint source evaluation methodology is presented in the Water Resources Element Appendix.

Future nutrient loads would decrease significantly in all watersheds, compared to current levels. This is due largely to the nonpoint source model's assumption[11] that nutrient-reducing Best Management Practices (BMPs) for urban stormwater and agricultural runoff would be more widely implemented by 2030. While significant progress has been made on BMPs, the County is uncertain as to whether these reduced "Tributary Strategy" loading rates are achievable, particularly given recent budgetary constratints.

As evidenced by the difference in nitrogen loads between Scenarios 1 and 2, efforts to encourage or mandate septic denitrification for new construction would only address a small portion of the County's overall nonpoint source load. However, these impacts are highly localized—denitrification in the Critical Area could result in more significant nitrogen reductions than in inland areas, and may have a more direct impact on the quality of receiving waters.

B. Total Nutrient Loading

Table 12 shows the total combined point and nonpoint source discharge in each 8-digit watershed in Talbot County. This table combines the information in Tables 10 and 11. As with the nonpoint source loadings alone, both scenarios would considerably reduce nutrient loading compared to existing levels, and both would result in comparable levels of nonpoint source nitrogen and phosphorus discharges.

C. Impervious Surface

Impervious surfaces are primarily human-made surfaces that do not allow rainwater to enter the ground. Impervious cover creates runoff that can cause stream bank erosion, sedimentation of streams, and adverse effects on water quality and aquatic life. The amount of impervious surface in a watershed is a key indicator of water quality. Water quality in streams tends to decline as watersheds approach ten percent impervious coverage, and drops sharply when the watershed approaches 25 percent impervious coverage. Table 13 summarizes existing and potential impervious coverage in Talbot County by watershed.

Countywide, more than three percent of all land is impervious. Even in Talbot County's most developed watersheds—the Miles River and Lower Choptank River—impervious surface coverage is under five percent. Under the land use and development scenarios considered in this Element, countywide impervious coverage would increase slightly by 2030, with most 8-digit watersheds experiencing some increase in impervious coverage.

While none of the County's major watersheds would approach ten percent impervious—the first tipping point with regard to water quality—some smaller sub-watersheds (particularly those in and around municipalities) may already approach or exceed such thresholds. In these cases, stormwater management retrofits can help to reduce the impact of large amounts of impervious surface.

[11] The model uses loading rates from the Chesapeake Bay Program Watershed Model , Phase 4.3.

Table 12. Total Nutrient Loading, All Scenarios

(all data in lbs/year)			Eastern Bay	Lower Chesapeake Bay	Lower Choptank River	Miles River	Tuckahoe Creek	Upper Choptank River	Wye River	Total
Existing	Nonpoint	TN	32,512	217	797,621	309,995	194,445	410,001	246,323	**1,991,113**
		TP	2,607	5	64,715	25,358	16,429	34,094	20,830	**164,039**
	Point	TN	0	5,000	9,800	7,400	0	23,800	200	**46,200**
		TP	0	1,700	1,783	1,403	0	2,400	50	**7,336**
	Total	**TN**	**32,512**	**5,217**	**807,421**	**317,395**	**194,445**	**433,801**	**246,523**	**2,037,313**
		TP	**2,607**	**1,705**	**66,498**	**26,761**	**16,429**	**36,494**	**20,880**	**171,375**
Scenario 1	Nonpoint	TN	19,836	161	496,799	194,955	114,924	245,315	137,268	**1,209,299**
		TP	1,746	4	43,220	16,957	11,065	22,934	14,015	**109,941**
	Point	TN	0	3,794	5,341	6,635	0	27,415	377	**43,562**
		TP	0	948	884	937	0	2,742	94	**5,605**
	Total	**TN**	**19,836**	**3,955**	**502,140**	**201,590**	**114,924**	**272,730**	**137,645**	**1,252,861**
		TP	**1,746**	**952**	**44,104**	**17,894**	**11,065**	**25,676**	**14,109**	**115,546**
Scenario 2	Nonpoint	TN	19,840	161	497,755	195,777	115,305	246,204	137,648	**1,212,690**
		TP	1,746	4	43,220	16,957	11,065	22,934	14,015	**109,941**
	Point	TN	0	3,794	5,341	6,635	0	27,415	377	**43,562**
		TP	0	948	884	937	0	2,742	94	**5,605**
	Total	**TN**	**19,840**	**3,955**	**503,096**	**202,412**	**115,305**	**273,619**	**138,025**	**1,256,252**
		TP	**1,746**	**952**	**44,104**	**17,894**	**11,065**	**25,676**	**14,109**	**115,546**

Table 13: Impervious Coverage

		Impervious Surface			
		Existing		**2030**	
Watershed	**Total Acreage[1]**	**Acres**	**Percent**	**Acres**	**Percent**
Eastern Bay	2,870	55	1.9%	56	2.0%
Lower Chesapeake Bay	142	1	0.4%	1	0.4%
Lower Choptank River	68,521	3,157	4.6%	3,352	4.9%
Miles River	27,368	1,225	4.5%	1,256	4.6%
Tuckahoe Creek	15,583	209	1.3%	230	1.5%
Upper Choptank River	36,371	717	2.0%	810	2.2%
Wye River	20,811	271	1.3%	292	1.4%
Total	**171,666**	**5,634**	**3.3%**	**5,997**	**3.5%**

Notes:

1: Excludes areas of open water within County boundaries.

D. Choice of Land Use Plan

The primary purpose of this Water Resources Element is to evaluate the water resources impacts of projected land use and development trends, and to provide input into the more detailed scenarios that may be considered as part of the next Comprehensive Plan update. As shown in Tables 11 and 12, the County's current land use plan, coupled with implementation of nonpoint source BMPs and upgrades to public wastewater treatment plants, could result in a substantial reduction in total nutrient loads to the Chesapeake Bay and its tributaries.

In revising the Comprehensive Plan, the County should take into account the findings of this Element, and should choose a future land use plan that continues to concentrate growth in and around existing municipalities and other developed areas.

VII. Water Resources Policies and Actions

This section describes policies and implementation strategies that the County should pursue in order to achieve the goals of this Water Resources Element.

1. Work with MDE, MGS, and USGS to complete the Coastal Plain Aquifer Study, and use the results of this study to guide future decisions regarding groundwater withdrawals.
2. Work with MDE to identify new sources of drinking water, specifically by evaluating the quality and quantity of water in the County's deeper and less frequently used aquifers.
3. Review the County's building and land development codes to ensure that water conserving fixtures and appliances are required for all new development and retrofits outside of public water systems.
4. Consider requiring all new development outside of existing or planned public sewer service areas to use septic denitrification systems.
5. Continue to use the County's share of Bay Restoration Fund payments to install approximately 100 denitrification units per year on existing septic systems, concentrating on septic systems in the Chesapeake Bay Critical Area.
6. Update the County's Water and Sewer Master Plan to reflect revised population and public water/sewer system data.
7. Continue to identify areas where failing septic systems or other public health concerns exist, and work with municipalities to extend public water and/or sewer service those areas.
8. Work with MDE to investigate options for upgrading the Region V WWTP to BNR or ENR technology.
9. Work with municipalities implement alternative wastewater disposal methods, such as land application of treated wastewater, tertiary treatment wetlands, wastewater reuse, and nutrient trading.
10. Amend the County's Stormwater Management ordinance to incorporate by reference the Maryland Stormwater Design manual, as revised by MDE to reflect provisions of the Stormwater Management Act of 2007—including the required use of ESD for new development.
11. Work with MDE, DNR, and the Maryland Department of Agriculture (MDA) to assist farmers in adopting Best Management Practices to reduce nonpoint source loads of nutrients and other pollutants.

12. Continue to support land preservation activities such as MALPF and Rural Legacy, and specifically encourage such activities (including the purchase of land by private conservation organizations) on land that drains to Tier II waterways, and in sub-watersheds where impervious coverage approaches or exceeds 10 percent.
13. As part of future Comprehensive Plan updates, thoroughly review and update the County's population projections, and re-run the nonpoint source loading analysis, incorporating up-to-date land use data and nutrient loading rates.
14. Consider participating in a regional water resources committee, along with MDE, MDP, and neighboring counties. The purpose of such a committee would be to coordinate information and decisions involving groundwater, surface water discharges (particularly to shared rivers such as the Choptank), and growth and development.